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(54) Light for motor vehicles

(57) A light for motor vehicles is proposed, in particular a signal light for motor vehicles, with three-phase light-emitting diodes (10) or light-emitting diode chips (21) as light sources, which are arranged on or in a base-plate (20). In the proposed light, three-phase light-emitting diodes (21) serve as the light sources, these diodes being white or transparent when in the unexcited state and emitting light of at least two different colours, for different lighting and/or signalling functions, it being possible to activate these functions, according to the signal colour desired, by applying different voltages.

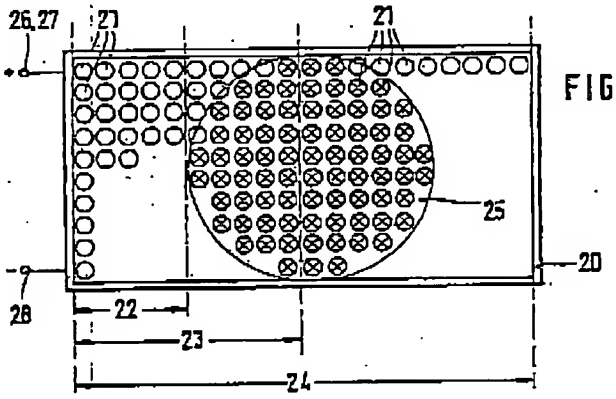

FIG.3

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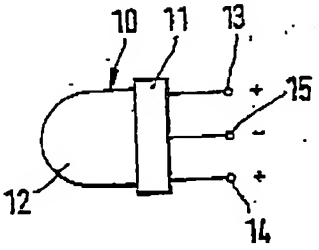
FIG. 1



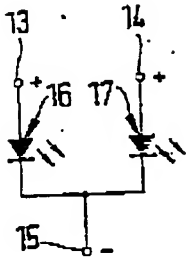


FIG. 2

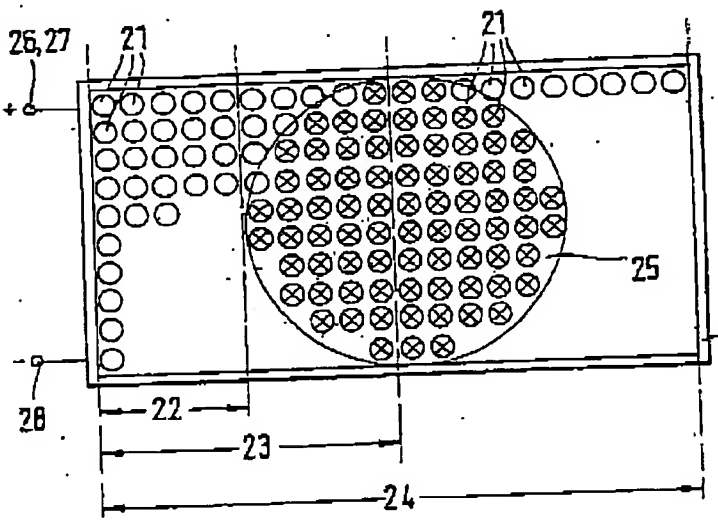


FIG. 3

FIG. 4

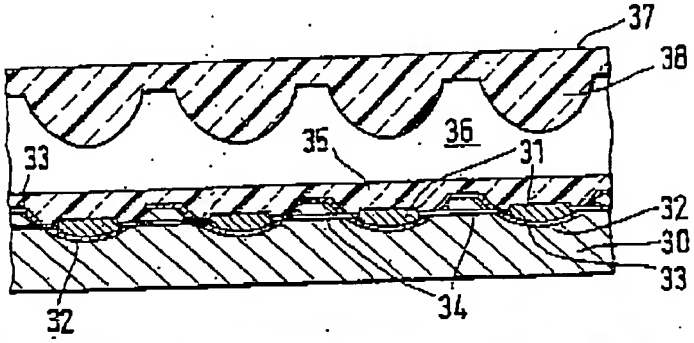
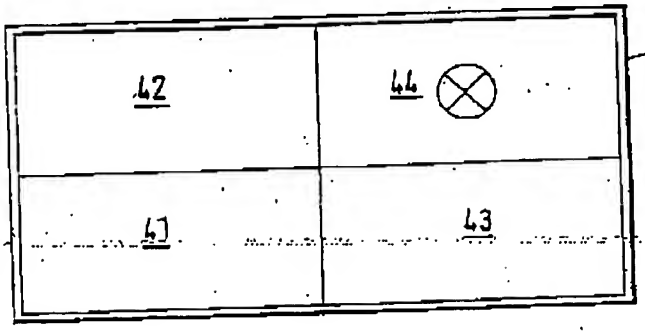


FIG. 5



SPECIFICATION

Light for motor vehicles

The invention derives from a motor vehicle light of the generic type specified in the main claim. An arrangement of this type is described in German Offenlegungsschrift 2,732,780, by reference to a motor vehicle safety-lighting system employing a reflective circuit board on phich light-emitting diodes are mounted, this circuit board being provided pith either a printed circuit or a conventional electrical circuit for the purpose of connecting up the light emitting diodes. The circuit board contains the lighting system and, at the same time, the electrical circuit. It is possible, by arranging the light-emitting diodes on the circuit board in a specific manner, to display numerals, letters, and the like.

Furthermore, German Offenlegungsschriften 2,837,596 and 2,837,635 disclose linear arrangements of light-emitting diodes. In these arrangements, the light-emitting diodes serve as indicating devices. They are composed of light-emitting diode chips phich are arranged on a printed circuit board, light-scattering elements being assigned to them in order to achieve specific optical effects.

Advantages of the Invention

The motor vehicle light according to the invention, possessing the characterising features of the main claim, has the advantage, compared to the prior art, that predetermined luminous effects, in different colours, can be obtained by simple means, the desired light being emitted by the same illuminating surfaces. As a result, it is possible to achieve luminous effects exhibiting particularly high intensities, since the production of light of different colours does not require the side-by-side arrangement of different light parts, so that the total illuminating surface is at all times available for light-emission.

The arrangement according to the invention has special advantages for motor vehicle signal lights, because lights of this type, for example, require different signal colours for the rear light and brake light, on the one hand, and for the flasher on the other hand, and these different colours can be arranged, in the proposed manner, on the same overall light exit surface. Furthermore, the configuration according to the invention presents the advantage that the visual impression made by a vehicle is not disturbed by a multiplicity of different coloured diffusing screens, because use is made of three-phase light-emitting diodes phich, phen in the unexcited state, possess a white or transparent appearance, similar, for instance, to that of adjacent headlights or reversing lights. In consequence, complicated arrangements for conferring a white colouration on the signal lights of the motor vehicle, or for rendering them transparent, can be dispensed with.

In addition, the use, according to the invention, of three-phase light-emitting diodes permits the indication of specific vehicle operating conditions without added expense. It is thus possible, for example, to obtain, from commercial sources, three-phase light-emitting diodes which light up either red or green, or red or yellow, depending on whether a voltage is applied to one anode line or the other. Moreover, if a voltage is applied to both anodes simultaneously, mixed colours can be produced, so that, for example, the mixed colour yellow is produced from red and green. With such an arrangement, it is possible, in addition to the conventional indications employing red light for rear lights or brake lights, and yellow light for flashers, to provide, for example a green indication of the vehicle operating condition, which indicates to a following vehicle that the leading vehicle is not in a braked condition, or in a condition in which it is about to brake.

An advantageous embodiment of the motor vehicle light according to the invention results from the application, to a common baseplate, of a plurality of light-emitting diode chips, in a matrix-like arrangement, instead of discrete light-emitting diodes. At the same time, it is expedient if the light-emitting diode chips are applied to a reflective surface coating on the baseplate, because, in this case, the light emerges at a particularly high intensity in the desired direction. The arrangement of light-emitting diode chips on a common baseplate is more advantageous from the production-engineering point of view than using individual, discrete light-emitting diodes, and hence simplifies the overall construction of the light according to the invention, as well as substantially reducing its cost. The reflective surface coating is expediently composed of a metal coating, prefferably an aluminium coating, which has been deposited by means of a vapour-deposition or sputtering process, coatings of this nature being known from other processes for the production of reflecting surfaces for motor vehicle lights. An electrically conductive metal plate is expediently used as the baseplate, preferably a copper plate which, at the same time, forms an electrical lead-in to the light-emitting diode chips. A single layer of transparent plastic, preferably composed of a polyester or of a silicone resin, is expediently used as a protective coating for all the light-emitting diode chips, the latter prefferably being located in dimple-like recesses in the baseplate. In order to achieve special optical-scattering effects, a coarsely roughened or similar texture can be imparted to the surface of the above mentioned transparent plastic layer, but a predetermined light-scattering effect is expediently produced, for the particular application in question, by

locating a separate diffusing screen over the plastic layer.

Drawing

Illustrative embodiments of the invention are represented, in diagrammatic form, in the drawings, and are explained in more detail in the description which follows. Figure 1 shows the external construction of a three-phase light emitting diode, Figure 2 shows the circuit set-up of a three-phase light-emitting diode Figure 3 shows a first illustrative embodiment of a motor vehicle Light employing three-phase light-emitting diodes in order to obtain different signal colours on the same illuminating surface, Figure 4 shows an enlarged representation in the form of a section through a motor vehicle light according to the invention, and Figure 5 shows a diagrammatic representation of another illustrative embodiment of the configuration, according to the invention, of a signal light for motor vehicles.

Description of the Illustrative Embodiments

In Figure 1, a three-phase light-emitting diode is marked 10, in its entirety. This light-emitting diode possesses a mounting base 11 and a light-diffusing cap 12 the latter being located on the former in the direction in which the light emerges, as well as connections 13 for a first anode, connections 14 for a second anode, and a cathode connection 15.

Figure 2 shows the circuit arrangement of a three-phase light-emitting diode 10. Once again, the two anodes are marked 13 and 14, and the cathode is marked 15. The actual light-emitting diodes are represented in the draping, by symbols, at 16 and 17.

Three-phase light-emitting diodes of this type can, for example, be obtained from the Telefunken company, under the designations CQX 31 or CQX 32, the first mentioned type emitting red or green light, according to choice, depending on whether a voltage is applied to the anode 13, or to the anode 14, while the second type of three-phase light-emitting diode mentioned emits red or yellow light, according to choice. If voltages are applied simultaneously to the two anodes, 13 and 14, a mixed colour is emitted, which, in the case of the green and red combination, is the yellow light colour used on motor vehicles, for signalling by means of flashers. Depending on the type of three-phase light-emitting diode used, the direct-current voltage applied to each anode ranges from 1.5 to 2.5 volts, while the physical size of an individual three-phase light-emitting diode, or of a corresponding three-phase light-emitting diode chip, approximates to 5 x 5 mm^2.

In Figure 3, a baseplate is marked 20, on which a number of discrete three-phase light-emitting diodes or light-emitting diode chips 21 are arranged, this number depending on the size of the plate. In order to obtain the desired lighting and/or signalling functions, this complete array of light-emitting diodes can be subdivided in different ways. In the case of the arrangement shown in Figure 3, two different distributions are indicated on the draping, namely either (sic) the vertically subdivided areas 22, 23, and 24, corresponding to the functions rear light/red, flasher/yellop, and brake light/red...(sic). The resulting luminous intensity depends, in an analogous manner, on the total area of the particular portion, 22, 23 or 24, to which a voltage is applied at the time in question. Another distribution is arranged so that an approximately circular area 25 can be switched on separately, for example in order to produce a yellow flasher inside a red brake light or reversing light. In order to produce the yellow coloration, a voltage is applied to both the anodes of a three-phase light-emitting diode which otherwise lights green or red according to choice. The two positive connections of the array are marked 26 and 27, while the negative connection is marked 28. In the case of the array depicted in Figure 3, ten light-emitting diodes or light-emitting diode chips are, in each case, series-connected between the positive and negative connections, corresponding to an applied voltage of 24 volts. The three-phase light-emitting diodes which are located side-by-side in a line are all connected in parallel to the first series-connection.

The signalling colour-areas explained by reference to Figure 3 represent only one illustrative embodiment, in which account is taken of the conventional or, as the case may be, legally prescribed luminous intensities for the various signalling fuctions, in that, for the normal rear light, the voltage is applied to a pro-portion of the light-emitting diodes which is appropriately reduced in comparison with that corresponding to the braking state. The rear light area 22 corresponds to approximately half the flasher area 23, and to approximately a quarter of the brake light area 24.

In addition to signal colours which are currently used in the case of motor vehicle lights, the proposed arrangement is also capable, for example, of emitting a green signal colour overall, as a sign that a leading motor vehicle is proceeding in a safe, cruising condition. On the other hand, the whole of the light area could be further subdivided, in order to indicate comparatively light braking action, or comparatively heavy braking action, by correspondingly fainter or more intense red brake light. Other variations are likewise possible.

In Figure 4, a baseplate is marked 30, this base-plate accommodating a plurality of three-phase light-emitting diode chips 31 in dimples 32. The entire surface of the baseplate 30, including the dimples 32, is provided with a reflective aluminium coating 33, in order to reflect the light radiated by the light-emitting

diodes in the prescribed direction, in the manner of a parabolic reflector. Connecting lines between the individual light-emitting diode chips 31 are indicated at 34. The base-plate 30 is expediently composed of a conductive material, for example copper, and can consequently be incorporated directly into the circuit arrangement, preferably as an earthed cathode. The complete array of light-emitting diode chips 31 is covered by a plastic layer 35, in order to protect them, while the light-scattering effect is produced, for the most part, by means of a separate diffusing screen 37 which is located at a distance above the chips 31, leaving open an air layer 36. This configuration also permits the light-scattering caps 38 to be pointed towards the interior of the light assembly, thereby facilitating the operation of cleaning the exterior of the complete light.

Figure 4 clearly shows that, in production-engineering and cost-related terms, a matrix-like array of light-emitting diode chips with a common poured-on sealing layer and a common diffusing screen is more favourable than the use of individual light-emitting diodes. On the other hand, the assembly procedure employing discrete components can be more expedient for small production runs of special lights. This applies, in particular, in cases where only slight soiling occurs. Discrete components cannot be coated without losing the prescribed scattering effects, but can, if need be, be provided with a common cover.

Figure 5 shows a further illustrative embodiment of the configuration of a light for motor vehicles, four different light-panels, 41, 42, 43 and 44, being provided on a baseplate 40. The light-panels 41, 42 and 43 can, for example, be designed, in turn, as a rear light, a flasher, and a brake light, while the light-panel 44 forms, for example, a reversing light. Since a white reversing light on the one hand does not disturb the aesthetic picture presented by a colourless or white light, and because on the other hand only modest requirements need be imposed with regard to the functional capability of a reversing light, it would be possible, in this case too, to provide a combined arrangement, composed of the panels 41 to 43 formed by light-emitting diodes, and a conventional light-emitting panel 44 with a light bulb located behind it. In addition to the aesthetic effect which the light produces, being uniform as a result of the colourless components, the above mentioned functional reliability of the array of light-emitting diodes represents an important technical advance. That is to say, in the event of the failure of individual light-emitting diodes, the complete assembly no longer becomes functionally unserviceable, as in the case of the failure of an individual light bulb. The light according to the invention thus makes a significant contribution to safety, in addition to a signalling function which can be varied in a multiplicity of ways.

CLAIMS

1. Light for motor vehicles, in particular a signal light for motor vehicles, with light-emitting diodes or light-emitting diode chips as light sources, which are arranged on or in a baseplate, characterised by the use of three-phase light-emitting diodes (10, 21, 31) which are white or transparent when in the unexcited state, and which emit light of at least two different colours for different lighting and/or signalling functions, it being possible to activate these functions, according to the signal colour desired, by applying different voltages (13, 14, 15, 26, 27, 28).

2. Light for motor vehicles according to Claim 1, characterised by use as a signal light, such as a brake light or flasher, or as a vehicle operating-condition indicator which emits light of different colours for different vehicle operating conditions, such as acceleration, cruising or braking.

3. Light for motor vehicles according to Claim 1, characterised in that various portions (22 to 25; 41 to 44) of an entire light-panel can be activated separately, in order to produce light of specific colours, and/or coloured signalling light at specific luminous intensities.

4. Light for motor vehicles according to Claim 1, characterised in that a plurality of light-emitting diode chips (31) are applied to a common baseplate (30), in a matrix-like arrangement.

5. Light for motor vehicles according to Claim 4, characterised in that the light-emitting diode chips (31) are applied to a reflective surface coating (33) on the baseplate (30).

6. Light for motor vehicles according to Claim 5, characterised in that the reflective surface coating (33) consists of a metal coating, preferably an aluminium coating, which has been deposited on the baseplate (30) by means of a vapour-deposition or sputtering process.

7. Light for motor vehicles according to one of Claims 4 to 6, characterised in that the light-emitting diode chips (31) are seated in dimple-like recesses (32) in the baseplate (30) and are all covered by a single layer (35) of transparent plastic.

8. Light for motor vehicles according to Claim 7, characterised in that the plastic layer (35) possesses an essentially plane surface and in that a predetermined light-scattering effect is produced by means of a separate diffusing screen (37) located over the plastic layer (35).

9. Any of the motor vehicle lights substantially as herein described with reference to the accompanying drawings.

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